WHAT IS CLAIMED IS:

1. An exchange coupling film comprising:

an antiferromagnetic layer; and

a ferromagnetic layer formed in contact with said antiferromagnetic layer, such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said ferromagnetic layer that fixes a magnetization of said ferromagnetic layer in a predetermined direction, wherein said antiferromagnetic layer comprises an antiferromagnetic material containing an element X and Mn, wherein said element X is selected from the group of elements consisting of Pt, Pd, Ir, Rh, Ru, and Os, and combinations thereof;

wherein said antiferromagnetic layer includes a region in which a ratio of an atomic percent of said element X to Mn increases in a direction towards said ferromagnetic layer; and

wherein a crystalline structure of at least a portion of said antiferromagnetic layer has a CuAu0I type face-centered square ordered lattice.

2. An exchange coupling film comprising:

an antiferromagnetic layer; and

a ferromagnetic layer formed in contact with said antiferromagnetic layer such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said ferromagnetic layer to fix a magnetization of said ferromagnetic layer in a predetermined direction, wherein said antiferromagnetic layer comprises an antiferromagnetic material containing an element X, an element X' and Mn, wherein said element X is selected from the group of elements consisting of Pt, Pd, Ir, Rh, Ru, and Os, and combinations thereof, wherein the element X' is selected from the group of elements consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Sn, Hf, Ta, W, Re, Au, Pb and a rare earth element and combinations thereof;

wherein said antiferromagnetic layer has a region in which a ratio of the atomic percent of the elements X + X' to Mn increases in a direction towards said ferromagnetic layer; and

wherein a crystalline structure of at least a portion of said antiferromagnetic layer has a CuAu0I type face-centered square ordered lattice.

3. An exchange coupling film according to Claim 2, wherein said antiferromagnetic material comprises one of an interstitial solid solution in which said element X' has invaded the interstices of a space lattice constituted by the element X and Mn, or a substitutive solid solution in which a portion of the lattice points of a crystal lattice constituted by said element X and Mn is substituted by said element X'.

4. An exchange coupling film according to Claim 1, wherein said antiferromagnetic layer has a lattice constant and said ferromagnetic layer has a lattice constant and wherein said lattice constants of said antiferromagnetic layer and said ferromagnetic layer have different values at at least part of said interface.

5. An exchange coupling film according to Claim 2, wherein said antiferromagnetic layer has a lattice constant and said ferromagnetic layer has a lattice constant and wherein said lattice constants of said antiferromagnetic layer and said ferromagnetic layer have different values at at least part of said interface.

6. An exchange coupling film according to Claim 1, wherein said antiferromagnetic layer has a crystalline orientation and said ferromagnetic layer has a crystalline orientation and wherein said crystalline orientations of said antiferromagnetic layer and said ferromagnetic layer differ at at least part of said interface.

7. An exchange coupling film according to Claim 2, wherein said antiferromagnetic layer has a crystalline orientation and said ferromagnetic layer has a crystalline orientation and wherein said crystalline orientations of said antiferromagnetic layer and said ferromagnetic layer differ at at least part of said interface.

8. An exchange coupling film according to one of Claims 1, wherein a non-aligned crystal lattice state exists at at least part of said interface.

9. An exchange coupling film according to one of Claims 2, wherein a non-aligned crystal lattice state exists at at least part of said interface.

10. An exchange coupling film according to Claim 1, wherein an imaginary boundary within a thickness of said antiferromagnetic layer resides in parallel with said interface so as to divide said antiferromagnetic layer into a first region between said imaginary boundary and said interface and a second region between said imaginary boundary and a face surface of said antiferromagnetic layer opposite to said interface, and wherein said antiferromagnetic has a region in which said ratio increases from said second region in a direction towards said first region across said imaginary boundary.

11. An exchange coupling film according to Claim 2, wherein an imaginary boundary within a thickness of said antiferromagnetic layer resides in parallel with said interface so as to divide said antiferromagnetic layer into a first region between said imaginary boundary and said interface and a second region between said imaginary boundary and a face surface of said antiferromagnetic layer opposite to said interface, and wherein said antiferromagnetic has a region in which said ratio increases from said second region in a direction towards said first region across said imaginary boundary.

12. An exchange coupling film according to Claim 1, wherein said antiferromagnetic layer includes a region in which a composition ratio (atomic percent) of said element X increases in a direction towards said ferromagnetic layer.

13. An exchange coupling film according to Claim 1, wherein said antiferromagnetic layer includes a region in which a composition ratio (atomic percent) of said elements X + X' increases in a direction towards said ferromagnetic layer.

14. An exchange coupling film according to Claim 1, wherein said antiferromagnetic layer includes a region in proximity to said interface and wherein a composition ratio (atomic percent) of said element X decreases in a direction towards said ferromagnetic layer.

15. An exchange coupling film according to Claim 1, wherein said antiferromagnetic layer includes a region in proximity to said interface and wherein a composition ratio (atomic percent) of said elements X + X' decreases in a direction towards said ferromagnetic layer.

16. An exchange coupling film according to Claim 12, wherein said antiferromagnetic layer further includes a region in proximity to said interface and wherein a composition ratio (atomic percent) of said element X decreases in a direction towards said ferromagnetic layer.

17. An exchange coupling film according to Claim 13, wherein said antiferromagnetic layer further includes a region in proximity to said interface and wherein the composition ratio (atomic percent) of said elements X + X' decreases in a direction towards said ferromagnetic layer.

18. An exchange coupling film according to Claim 1, wherein said antiferromagnetic layer includes a region in proximity to a face surface thereof opposite to said interface and wherein a composition ratio (atomic percent) of said element X decreases in a direction away from said ferromagnetic layer.

19. An exchange coupling film according to Claim 2,, wherein said antiferromagnetic layer includes a region in proximity to a face surface thereof opposite to said interface and wherein a composition ratio (atomic percent) of said element X decreases in a direction away from said ferromagnetic layer.

20. An exchange coupling film according to Claim 12, , wherein said antiferromagnetic layer includes a region in proximity to a face surface thereof opposite to said interface and wherein a composition ratio (atomic percent) of said element X decreases in a direction away from said ferromagnetic layer.

21. An exchange coupling film according to Claim 13, wherein said antiferromagnetic layer further includes a region in proximity to a face surface thereof

opposite to said interface and wherein a composition ratio (atomic percent) of said elements X + X' decreases in a direction away from said ferromagnetic layer.

22. An exchange coupling film according to Claim 14, wherein said antiferromagnetic layer further includes a region in proximity to a face surface thereof opposite to said interface and wherein a composition ratio (atomic percent) of said element X decreases in a direction away from said ferromagnetic layer.

23. An exchange coupling film according to Claim 15, wherein said antiferromagnetic layer further includes a region in proximity to a face surface thereof opposite to said interface and wherein a composition ratio (atomic percent) of said elements X + X' decreases in a direction away from said ferromagnetic layer.

24. An exchange coupling film according to Claim 16, wherein said antiferromagnetic layer further includes a region in proximity to a face surface thereof opposite to said interface and wherein a composition ratio (atomic percent) of said element X decreases in a direction away from said ferromagnetic layer.

25. An exchange coupling film according to Claim 17, wherein said antiferromagnetic layer further includes a region in proximity to a face surface thereof opposite to said interface and wherein a composition ratio (atomic percent) of said elements X + X' decreases in a direction away from said ferromagnetic layer.

26. An exchange coupling film according to Claim 1, wherein a composition ratio of said element X of said antiferromagnetic layer to a total composition ratio 100 at% of all elements constituting said antiferromagnetic layer is about 50 at% to about 65 at%, in a region in proximity to said interface between said antiferromagnetic layer and said ferromagnetic layer.

27. An exchange coupling film according to Claim 2, wherein a composition ratio of said elements X + X' of said antiferromagnetic layer to a total composition ratio 100 at% of all elements constituting said antiferromagnetic layer is about 50 at% to about 65

at%, in the region in proximity to said interface between said antiferromagnetic layer and said ferromagnetic layer.

28. An exchange coupling film according to Claim 26, wherein a composition ratio of said element X is about 50 at% to about 60 at%.

29. An exchange coupling film according to Claim 27, wherein a composition ratio of said elements X + X' is about 50 at% to about 60 at%.

30. An exchange coupling film according to Claim 1, wherein a composition ratio of said element X of said antiferromagnetic layer to a total composition ratio 100 at% of all elements constituting said antiferromagnetic layer is about 44 at% to about 57 at%, in a region in proximity to a face surface of said antiferromagnetic layer opposite to said interface.

31. An exchange coupling film according to Claim 2, wherein a composition ratio of said elements X + X' of said antiferromagnetic layer to a total composition ratio 100 at% of all elements constituting said antiferromagnetic layer is about 44 at% to about 57 at%, in a region in proximity to a face surface of said antiferromagnetic layer opposite to said interface.

32. An exchange coupling film according to Claim 26, wherein a composition ratio of said element X of said antiferromagnetic layer to said total composition ratio 100 at% of all elements constituting said antiferromagnetic layer is about 44 at% to about 57 at%, in a region proximate to a face surface of said antiferromagnetic layer opposite to said interface.

33. An exchange coupling film according to Claim 27, wherein a composition ratio of said elements X + X' of said antiferromagnetic layer to the total composition ratio 100 at% of all the elements constituting said antiferromagnetic layer is about 44 at% to about 57 at%, in the region near the face of said antiferromagnetic layer opposite to the interface adjacent to said ferromagnetic layer.

34. An exchange coupling film according to Claim 28, wherein a composition ratio of said elements X + X' of said antiferromagnetic layer to a total composition ratio 100 at% of all said elements constituting said antiferromagnetic layer is about 44 at% to about 57 at%, in a region near a face of said antiferromagnetic layer opposite to an interface adjacent to said ferromagnetic layer.

35. An exchange coupling film according to Claim 29,, wherein a composition ratio of said elements X + X' of said antiferromagnetic layer to a total composition ratio 100 at% of all said elements constituting said antiferromagnetic layer is about 44 at% to about 57 at%, in a region near a face of said antiferromagnetic layer opposite to an interface adjacent to said ferromagnetic layer.

36. An exchange coupling film according to Claim 30, wherein said composition ratio of said element X is about 46 at% to about 55 at% in said region in proximity to said face surface.

37. An exchange coupling film according to Claim 31, wherein said composition ratio of said elements X + X' is about 46 at% to about 55 at% in said region proximate to said face surface.

38. An exchange coupling film according to Claim 32, wherein said composition ratio of said element X is about 46 at% to about 55 at% in said region proximate to said face surface.

39. An exchange coupling film according to Claim 33, wherein said composition ratio of said elements X + X' is about 46 at% to about 55 at% in said region proximate to said face surface.

40. An exchange coupling film according to Claim 34, wherein said composition ratio of said element X is about 46 at% to about 55 at% in said region proximate to said face surface.

41. An exchange coupling film according to Claim 35, wherein said composition ratio of said elements X + X' is about 46 at% to about 55 at% in said region proximate to said face surface.

42. An exchange coupling film according to Claim 1, wherein said antiferromagnetic layer has a thickness of at least about 73 Å.

43. An exchange coupling film according to Claim 2, wherein said antiferromagnetic layer has a thickness of at least about 73 Å.

44. A magnetoresistive sensor comprising:

an antiferromagnetic layer; and

a pinned magnetic layer in contact with said antiferromagnetic layer such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said pinned magnetic layer that fixes a magnetization of said pinned magnetic layer in a predetermined direction;

a non-magnetic intermediate layer formed between said pinned magnetic layer and a free magnetic layer; and

a bias layer adjacent to side surfaces of said free magnetic layer which align a direction of magnetization of said free magnetic layer in a direction intersecting said predetermined direction of magnetization of said pinned magnetic layer;

wherein said antiferromagnetic layer and said pinned magnetic layer comprise an exchange coupling film as claimed by Claim 1.

45. A magnetoresistive sensor comprising:

an antiferromagnetic layer; and

a pinned magnetic layer in contact with said antiferromagnetic layer such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said pinned magnetic layer that fixes a magnetization of said pinned magnetic layer in a predetermined direction;

a non-magnetic intermediate layer formed between said pinned magnetic layer and a free magnetic layer; and

a bias layer adjacent to side surfaces of said free magnetic layer which align a direction of magnetization of said free magnetic layer in a direction intersecting said predetermined direction of magnetization of said pinned magnetic layer;

wherein said antiferromagnetic layer and said pinned magnetic layer comprise an exchange coupling film as claimed by Claim 2.

46. A magnetoresistive sensor comprising:

an antiferromagnetic layer; and

a pinned magnetic layer in contact with said antiferromagnetic layer such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said pinned magnetic layer that fixes a magnetization of said pinned magnetic layer in a predetermined direction;

a non-magnetic intermediate layer formed between said pinned magnetic layer and a free magnetic layer; and

an antiferromagnetic exchange bias layer adjacent to one of an upper side or a lower side of said free magnetic layer and having portions spaced from each other in a track width direction;

wherein said exchange bias layer and said free magnetic layer comprise an exchange coupling film as claimed by Claim 1; and

wherein a magnetization of said free magnetic layer is fixed in a predetermined direction.

47. A magnetoresistive sensor comprising:

an antiferromagnetic layer; and

a pinned magnetic layer in contact with said antiferromagnetic layer such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said pinned magnetic layer that fixes a magnetization of said pinned magnetic layer in a predetermined direction;

a non-magnetic intermediate layer formed between said pinned magnetic layer and a free magnetic layer; and

an antiferromagnetic exchange bias layer adjacent to one of an upper side or a lower side of said free magnetic layer and having portions spaced from each other in a track width direction;

wherein said exchange bias layer and said free magnetic layer comprise an exchange coupling film as claimed by Claim 2; and

wherein a magnetization of said free magnetic layer is fixed in a predetermined direction.

48. A magnetoresistive sensor comprising:

a free magnetic layer;

first and second non-magnetic intermediate layers adjacent to an upper side and a lower side of said free magnetic layer, respectively;

first and second pinned magnetic layers, wherein said first pinned magnetic layer is adjacent to an upper side of said first non-magnetic intermediate layer and said second pinned magnetic layer is adjacent to a lower side of said second non-magnetic intermediate layer;

first and second antiferromagnetic layers, wherein said first antiferromagnetic layer is adjacent to an upper side of said first pinned magnetic layer said second antiferromagnetic layer is adjacent to a lower side of said second pinned magnetic layer, said first and second antiferromagnetic layers serving to fix directions of magnetization of said first and second pinned magnetic layers, respectively, by exchange anisotropic magnetic fields; and

a bias layer adjacent to side surfaces of said free magnetic layer which aligns a direction of magnetization of said free magnetic layer to a direction that intersects the directions of magnetization of said first and second pinned magnetic layers;

wherein one of said first antiferromagnetic layer and said first or said second antiferromagnetic layer and said second pinned magnetic layer pinned magnetic layer comprise an exchange coupling film as claimed by Claim 1.

49. A magnetoresistive sensor comprising:

a free magnetic layer;

first and second non-magnetic intermediate layers adjacent to an upper side and a lower side of said free magnetic layer respectively;

first and second pinned magnetic layers, wherein said first pinned magnetic layer is adjacent to an upper side of said first non-magnetic intermediate layer and said second pinned magnetic layer is adjacent to a said second non-magnetic intermediate layer;

first and second antiferromagnetic layers, wherein said first antiferromagnetic layer is adjacent to an upper side of said first pinned magnetic layers and said second antiferromagnetic layer is adjacent to a lower side of said second pinned magnetic layer, said first and second antiferromagnetic layers serving to fix directions of magnetization of said first and second pinned magnetic layers, respectively, by exchange anisotropic magnetic fields; and

a bias layer adjacent to side surfaces of said free magnetic layer which aligns a direction of magnetization of the free magnetic layer to a direction that intersects said directions of said pinned magnetic layers;

wherein one of said first antiferromagnetic layer and said first pinned magnetic layer or said anti-ferromagnetic layer and said second pinned magnetic layer, at at least one of the upper and lower sides of said free magnetic layer comprise an exchange coupling film as claimed by Claim 2.

50. A magnetoresistive sensor comprising:

a non-magnetic layer;

a magnetoresistive layer and a soft magnetic layer separated by said non-magnetic layer; and

an antiferromagnetic layer adjacent to one of an upper side or a lower side of said magnetoresistive layer and having portions spaced from each other in a track width direction;

wherein said antiferromagnetic layer and said magnetoresistive layer and said magnetoresistive layer comprise an exchange coupling film as claimed by Claim 1.

51. A magnetoresistive sensor comprising:

a non-magnetic layer;

a magnetoresistive layer and a soft magnetic layer separated by said non-magnetic layer; and

an antiferromagnetic layer adjacent to one of an upper side or a lower side of said magnetoresistive layer and having portions spaced from each other in a track width direction;

wherein said antiferromagnetic layer and said magnetoresistive layer and said magnetoresistive layer comprise an exchange coupling film as claimed by Claim 2.

52. An exchange coupling film comprising:

an antiferromagnetic layer; and

a ferromagnetic layer formed such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said ferromagnetic layer, wherein said antiferromagnetic layer comprises an antiferromagnetic material containing an element X and Mn, where said element X is selected from the group of elements consisting of Pt, Pd, Ir, Rh, Ru, and Os and combinations thereof;

wherein said antiferromagnetic layer includes a first region in which a ratio of an atomic percent of said element X to Mn increases in a direction towards said ferromagnetic layer starting from a thicknesswise central region and a second region in which said ratio of said atomic percent of said element X to Mn increases in a direction away from said ferromagnetic layer starting from said thicknesswise central region; and

wherein a crystalline structure of at least part of said antiferromagnetic layer has a CuAu0I type face-centered square ordered lattice.

53. An exchange coupling film comprising:

an antiferromagnetic layer; and

a ferromagnetic layer formed such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said ferromagnetic layer, wherein said antiferromagnetic layer comprises an antiferromagnetic material containing an element X, an element X' and Mn, where said element X is selected from the group of elements consisting of Pt, Pd, Ir, Rh, Ru, and Os and combinations thereof, and said element X' is selected from the group of elements consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Sn,

Hf, Ta, W, Re, Au, Pb and a rare earth element and combinations thereof and combinations thereof;

wherein said antiferromagnetic layer has a first region in which a ratio of the atomic percent of the elements X + X' to Mn increases in a direction towards said ferromagnetic layer starting from a thicknesswise central region and a second region in which said ratio of the atomic percent of the elements X + X' to Mn increases in a direction away from said ferromagnetic layer starting from said thicknesswise central region; and

wherein a crystalline structure of at least a portion of said antiferromagnetic layer has a CuAu0I type face-centered square ordered lattice.

54. An exchange coupling film according to Claim 53, wherein said antiferromagnetic material containing an element X, an element X' and Mn comprises one of an interstitial solid solution in which said element X' resides in interstices of a space lattice constituted said the element X and Mn, or a substitutive solid solution in which a portion of lattice points of a crystal lattice constituted by said element X and Mn are substituted by said element X'.

55. An exchange coupling film according to Claim 52, further comprising a seed layer formed on a side of said antiferromagnetic layer opposite to said interface, said seed layer having face-centered cubic crystals with substantially oriented (111) planes, said antiferromagnetic layer and said ferromagnetic layer having crystalline orientations with (111) planes substantially oriented in parallel with said interface.

56. An exchange coupling film according to Claim 53, further comprising a seed layer formed on a side of said antiferromagnetic layer opposite to said interface, said seed layer having face-centered cubic crystals with substantially oriented (111) planes, wherein said antiferromagnetic layer and said ferromagnetic layer have crystalline orientations with (111) planes substantially oriented in parallel with said interface.

57. An exchange coupling film according to Claim 55, wherein said antiferromagnetic layer has a lattice constant and wherein said seed layer has a lattice

constant and wherein said lattice constants of said antiferromagnetic layer and said seed layer differ at at least part of the interface therebetween.

58. An exchange coupling film according to Claim 56, wherein said antiferromagnetic layer has a lattice constant and wherein said seed layer has a lattice constant and wherein said lattice constant of said antiferromagnetic layer and said seed layer differ at at least part of the interface therebetween.

59. An exchange coupling film according to Claim 55, wherein a non-aligned crystal lattice state exists at at least part of an interface between said antiferromagnetic layer and said seed layer.

60. An exchange coupling film according to Claim 56, wherein a non-aligned crystal lattice state exists at at least part of an interface between said antiferromagnetic layer and said seed layer.

61. An exchange coupling film according to Claim 55, wherein said seed layer comprises one of an Ni-Fe alloy or an Ni-Fe-Y alloy, wherein Y is selected from the group consisting of Cr, Rh, Ta, Hf, Nb, Zr, and Ti and combinations thereof.

62. An exchange coupling film according to Claim 56, wherein said seed layer comprises one of an Ni-Fe alloy or an Ni-Fe-Y alloy, wherein Y is selected from the group consisting of Cr, Rh, Ta, Hf, Nb, Zr, and Ti and combinations thereof.

63. An exchange coupling film according to Claim 55, wherein said seed layer comprises a non-magnetic layer.

64. An exchange coupling film according to Claim 56, wherein said seed layer comprises a non-magnetic layer.

65. An exchange coupling film according to Claim 55, wherein said seed layer, said antiferromagnetic layer, and said ferromagnetic layer are sequentially positioned on

an underlying layer, wherein said underlying layer comprises at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo and W.

66. An exchange coupling film according to Claim 56, wherein said seed layer, said antiferromagnetic layer, and said ferromagnetic layer are sequentially positioned on an underlying layer, wherein said underlying layer comprises at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo and W.

67. An exchange coupling film according to Claim 52, wherein a layer comprising elements selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo and W and combinations thereof is positioned on a side of said antiferromagnetic layer opposite to said interface.

68. An exchange coupling film according to Claim 53, wherein a layer comprising elements selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo and W is positioned on a side of said antiferromagnetic layer opposite to said interface.

69. An exchange coupling film according to Claim 52, wherein, a first imaginary boundary at a side of said thicknesswise central region of said antiferromagnetic layer in proximity to a face surface of said antiferromagnetic layer opposite to said interface and a second imaginary boundary at a side of said thicknesswise central region in proximity to said interface, wherein said ratio is greater in a first region between said face surface of said antiferromagnetic layer and said first imaginary boundary and in a third region between said interface and said second imaginary boundary than in a second region between said first and second imaginary boundaries, and wherein said ratio increases from said second region in a direction towards said first region across said first imaginary boundary and from said second region in a direction towards said third region across said second imaginary boundary.

70. An exchange coupling film according to Claim 53, wherein, a first imaginary boundary at a side of said thicknesswise central region of said antiferromagnetic layer in proximity to a face surface of said antiferromagnetic layer opposite to said interface and a

second imaginary boundary at a side of said thicknesswise central region in proximity to said interface, wherein said ratio is greater in a first region between said face surface of said antiferromagnetic layer and said first imaginary boundary and in a third region between said interface and said second imaginary boundary than in a second region between said first and second imaginary boundaries, and wherein said ratio increases from said second region in a direction towards said first region across said first imaginary boundary and from said second region in a direction towards said third region across said second imaginary boundary.

71. An exchange coupling film according to Claim 52, wherein said antiferromagnetic layer includes a first region in which an atomic percent of said element X increases in a direction towards said interface starting from a predetermined thicknesswise central region, and a second region in which an atomic percent of said element X increases in a direction towards a side opposite to said interface starting from said predetermined thicknesswise central region,

72. An exchange coupling film according to Claim 53, wherein said antiferromagnetic layer includes a first region in which an atomic percent of said elements X + X' increases in a direction towards said interface starting from a predetermined thicknesswise central region, and a second region in which an atomic percent of said elements X + X' increases in a direction towards a side opposite to said interface starting from said predetermined thicknesswise central region,

73. An exchange coupling film according to Claim 52, wherein said antiferromagnetic layer includes a first region in which an atomic percent of said element X decreases in a direction towards said interface, and a second region in which an atomic percent of said element X decreases in a direction towards a side of said antiferromagnetic layer opposite to said interface.

74. An exchange coupling film according to Claim 53, wherein said antiferromagnetic layer includes a first region in which an atomic percent of said elements X + X' decreases in a direction towards said interface, and a second region in

which an atomic percent of said elements X + X' decreases in a direction towards a side of said antiferromagnetic layer opposite to said interface.

75. An exchange coupling film according to Claim 71, wherein said antiferromagnetic layer includes a first region in which an atomic percent of said element X decreases in a direction towards said interface, and a second region in which an atomic percent of said element X decreases in a direction towards a side of said antiferromagnetic layer opposite to said interface.

76. An exchange coupling film according to Claim 72, wherein said antiferromagnetic layer includes a first region in which an atomic percent of said elements X + X' decreases in a direction towards said interface, and a second region in which an atomic percent of said element X + X' decreases in a direction towards a side of said antiferromagnetic layer opposite to said interface.

77. An exchange coupling film according to Claim 52, wherein a composition ratio of said element X of said antiferromagnetic layer to a total composition ratio 100 at% of all elements constituting portions of said antiferromagnetic layer in proximity to said interface and in proximity to a side opposite to said interface is about 50 at% to about 65 at%, in said portion the region in proximity to said interface.

78. An exchange coupling film according to Claim 53, wherein a composition ratio of said elements X + X' of said antiferromagnetic layer to a total composition ratio 100 at% of all elements constituting portions of said antiferromagnetic layer in proximity to said interface and in proximity to said a side opposite to said interface is about 50 at% to about 65 at%, in said portion in proximity to said interface.

79. An exchange coupling layer according to Claim 77, wherein said composition ratio of said element X is about 50 at% to about 60 at% at each of said portions of said antiferromagnetic layer.

80. An exchange coupling layer according to Claim 78, wherein said composition ratio of said elements X + X' is about 50 at% to about 60 at% at each of said portions of said antiferromagnetic layer.

81. An exchange coupling film according to Claim 52, wherein said thicknesswise central region has an atomic percent of said element X to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 44 at% to about 57 at%.

82. An exchange coupling film according to Claim 53, wherein said thicknesswise central region has an atomic percent of said elements X + X' to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 44 at% to about 57 at%.

83. An exchange coupling film according to Claim 77, wherein said thicknesswise central region atomic percent of said element X to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 44 at% to about 57 at%.

84. An exchange coupling film according to Claim 78, wherein said thicknesswise central region has an atomic percent of said elements X + X' to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 44 at% to about 57 at%.

85. An exchange coupling film according to Claim 79, wherein said thicknesswise central region has an atomic percent of said element X to total composition ratio 100 at% of all the elements in said thicknesswise central region is about 44 at% to about 57 at%.

86. An exchange coupling film according to Claim 80, wherein said thicknesswise central region has an atomic percent of said elements X + X' to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 44 at% to about 57 at%.

87. An exchange coupling film according to Claim 81, wherein said thicknesswise central region has an atomic percent of said element X to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 46 at% to about 55 at%.

88. An exchange coupling film according to Claim 82, wherein said thicknesswise central region has an atomic percent of said elements X + X' to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 46 at% to about 55 at%.

89. An exchange coupling film according to Claim 83, wherein said thicknesswise central region has an atomic percent of said elements X + X' to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 46 at% to about 55 at%.

90. An exchange coupling film according to Claim 84, wherein said thicknesswise central region has an atomic percent of said elements X + X' to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 46 at% to about 55 at%.

91. An exchange coupling film according to Claim 85, wherein said thicknesswise central region has an atomic percent of said element X to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 46 at% to about 55 at%.

92. An exchange coupling film according to Claim 86, wherein said thicknesswise central region has an atomic percent of said elements X + X' to a total composition ratio 100 at% of all elements in said thicknesswise central region is about 46 at% to about 55 at%.

93. An exchange coupling film according to Claim 52, wherein said antiferromagnetic layer has a thickness of at least about 76 Å.

94. An exchange coupling film according to Claim 53, wherein said antiferromagnetic layer has a thickness of at least about 76 Å.

95. An exchange coupling film according to Claim 52, wherein said antiferromagnetic layer has a lattice constant and said ferromagnetic layer has a lattice constant and wherein

said lattice constants of said antiferromagnetic layer and said ferromagnetic layer have different valves at said interface.

96. An exchange coupling film according to Claim 53, wherein said antiferromagnetic layer has a lattice constant and said ferromagnetic layer has a lattice constant and wherein said lattice constants of said antiferromagnetic layer and said ferromagnetic layer have different valves at said interface.

97. An exchange coupling film according to Claim 52, wherein said antiferromagnetic layer has a crystalline orientation and said ferromagnetic layer has a crystalline orientation and wherein said crystalline orientation of said antiferromagnetic layer and said ferromagnetic layer differ at said interface.

98. An exchange coupling film according to Claim 53, wherein said antiferromagnetic layer has a crystalline orientation and said ferromagnetic layer has a crystalline orientation and wherein said crystalline orientation of said antiferromagnetic layer and said ferromagnetic layer differ at said interface.

99. An exchange coupling film according to Claim 52, wherein a non-aligned crystal lattice state exists at at least part of said interface between said antiferromagnetic layer and said ferromagnetic layer.

100. An exchange coupling film according to Claim 53, wherein a non-aligned crystal lattice state exists at at least part of said interface between said antiferromagnetic layer and said ferromagnetic layer.

101. A magnetoresistive sensor comprising:

an antiferromagnetic layer; and

a pinned magnetic layer in contact with said antiferromagnetic layer such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said pinned magnetic layer that fixes a magnetization of said pinned magnetic layer in a predetermined direction;

a non-magnetic intermediate layer between said pinned magnetic layer and a free magnetic layer; and

a bias layer adjacent to side surfaces of said free magnetic layer which aligns a direction of magnetization of said free magnetic layer in a direction intersecting said predetermined direction of magnetization of said pinned magnetic layer;

wherein said antiferromagnetic layer and said pinned magnetic layer comprise an exchange coupling film as claimed by Claim 52.

102. A magnetoresistive sensor comprising:

an antiferromagnetic layer; and

a pinned magnetic layer in contact with said antiferromagnetic layer such that an exchange coupling magnetic field is produced at the interface between said antiferromagnetic layer and said pinned magnetic layer to fix the magnetization of said pinned magnetic layer in a predetermined direction;

a non-magnetic intermediate layer formed between said pinned magnetic layer and a free magnetic layer; and

a bias layer adjacent to side surfaces of said free magnetic layer which aligns the direction of magnetization of said free magnetic layer in a direction intersecting the direction of magnetization of said pinned magnetic layer;

wherein said antiferromagnetic layer and said pinned magnetic layer comprise an exchange coupling film as claimed by Claim 53.

103. A magnetoresistive sensor comprising:

an antiferromagnetic layer; and

a pinned magnetic layer in contact with said antiferromagnetic layer such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said pinned magnetic layer that fixes a magnetization of said pinned magnetic layer in a predetermined direction;

a non-magnetic intermediate layer between said pinned magnetic layer and a free magnetic layer; and

an antiferromagnetic exchange bias layer adjacent to one of an upper side or a lower side of said free magnetic layer and having portions spaced from each other in a track width direction;

wherein said exchange bias layer and said free magnetic layer comprise exchange coupling film as claims by Claim 52.

104. A magnetoresistive sensor comprising:

an antiferromagnetic layer; and

a pinned magnetic layer in contact with said antiferromagnetic layer such that an exchange coupling magnetic field is produced at an interface between said antiferromagnetic layer and said pinned magnetic layer that fixes a magnetization of said pinned magnetic layer in a predetermined direction;

a non-magnetic intermediate layer between said pinned magnetic layer and a free magnetic layer; and

an antiferromagnetic exchange bias layer adjacent to one of an upper side or a lower side of said free magnetic layer and having portions spaced from each other in a track width direction;

wherein said exchange bias layer and said free magnetic layer comprise an exchange coupling film as claims by Claim 53.

105. A magnetoresistive sensor comprising:

a free magnetic layer;

first and second non-magnetic intermediate layers on upper and lower sides of said free magnetic layer, respectively;

first and second pinned magnetic layers, wherein said first pinned magnetic layer is on an upper side of said first non-magnetic intermediate layer, said second pinned magnetic layer is on a lower side of said second non-magnetic intermediate layer;

first and second antiferromagnetic layers, wherein said first antiferromagnetic layer is on an upper side of said first pinned magnetic layer and said second antiferromagnetic layer is on a lower side of said second pinned magnetic layer, wherein said first and second antiferromagnetic layers serve to fix directions of magnetization of said first and

second pinned magnetic layers, respectively, by exchange anisotropic magnetic fields; and

a bias layer adjacent to side surface of said free magnetic layer which aligns a direction of magnetization of said free magnetic layer to a direction that intersects directions of magnetization of said first and second pinned magnetic layers;

wherein at least one of said first antiferromagnetic layer and said first pinned magnetic layer or said second antiferromagnetic layer and said second pinned magnetic layer comprise an exchange coupling film as claimed by Claim 52.

106. A magnetoresistive sensor comprising:

a free magnetic layer;

first and second non-magnetic intermediate layers on upper and lower sides of said free magnetic layer, respectively;

first and second pinned magnetic layers, wherein said first pinned magnetic layer is on an upper side of said first non-magnetic intermediate layer, said second pinned magnetic layer is on a lower side of said second non-magnetic intermediate layer;

first and second antiferromagnetic layers, wherein said first antiferromagnetic layer is on an upper side of said first pinned magnetic layer and said second antiferromagnetic layer is on a lower side of said second pinned magnetic layer, wherein said first and second antiferromagnetic layers serve to fix directions of magnetization of said first and second pinned magnetic layers, respectively, by exchange anisotropic magnetic fields; and

a bias layer adjacent to side surfaces of said free magnetic layer which aligns a direction of magnetization of said free magnetic layer to a direction that intersects directions of magnetization of said first and second pinned magnetic layers;

wherein at least one of said first antiferromagnetic layer and said first pinned magnetic layer or said second antiferromagnetic layer and said second pinned magnetic layer comprise an exchange coupling film as claimed by Claim 53.

107. A magnetoresistive sensor comprising:

a non-magnetic layer;

a magnetoresistive layer and a soft magnetic layer separated by said non-magnetic layer; and

an antiferromagnetic layer on one of an upper side or a lower side of said magnetoresistive layer and having portions spaced from each other in a track width direction;

wherein said antiferromagnetic layer and said magnetoresistive layer and said magnetoresistive layer comprise an exchange coupling film as claimed by Claim 52.

108. A magnetoresistive sensor comprising:

a non-magnetic layer;

a magnetoresistive layer and a soft magnetic layer separated by said non-magnetic layer; and

an antiferromagnetic layer on one of an side or a lower side of said magnetoresistive layer and having portions spaced from each other in a track width direction;

wherein said antiferromagnetic layer and said magnetoresistive layer and said magnetoresistive layer comprise an exchange coupling film as claimed by Claim 53.

109. An exchange coupling film according to Claim 30, wherein said composition ratio of said element X is about 46 at% to about 55 at%.